Wireless Application Protocol (WAP)

by H. Steeman

The WAP (Wireless Application Protocol) is currently a hot subject in the world of mobile telephony. Almost all operators of mobile telephone networks are developing the infrastructure needed to allow them to offer WAP to their customers.

Information providers, in turn, are busy making existing information suitable for distribution via WAP. The first WAP terminals are already available. Although the Internet has been available to private users for only a few years, it has become an indispensable part of modern society. Previously, you would go to a library to look for background information, but now the Internet is by far the most important source of information. A natural consequence is that more and more users want to have access to the Internet 24 hours a day (at home, at work and while travelling). In order to meet this need, the most obvious solution is to use mobile phones, either on their own or in combination with electronic organisers or personal digital assistants (PDAs). Most organisers, such as the Psion 5mx, the Palm V, the Nokia 9110 and the Compaq Aero, can be equipped with true Web browsers, and some even have Java support. However, in practice it turns out that the limitations of the mobile phone that is used for data transmission, the processing power of the mobile terminal and the resolution of the display do not allow existing Internet pages to be consulted in a usable manner. Consequently, a new standard has been proposed for displaying information from the Internet on mobile equipment: the Wireless Application Protocol.

In practice, the Wireless Application Protocol employs WML pages. These are derived from the HTML pages that are used on the Internet. There are many similarities between the two formats.

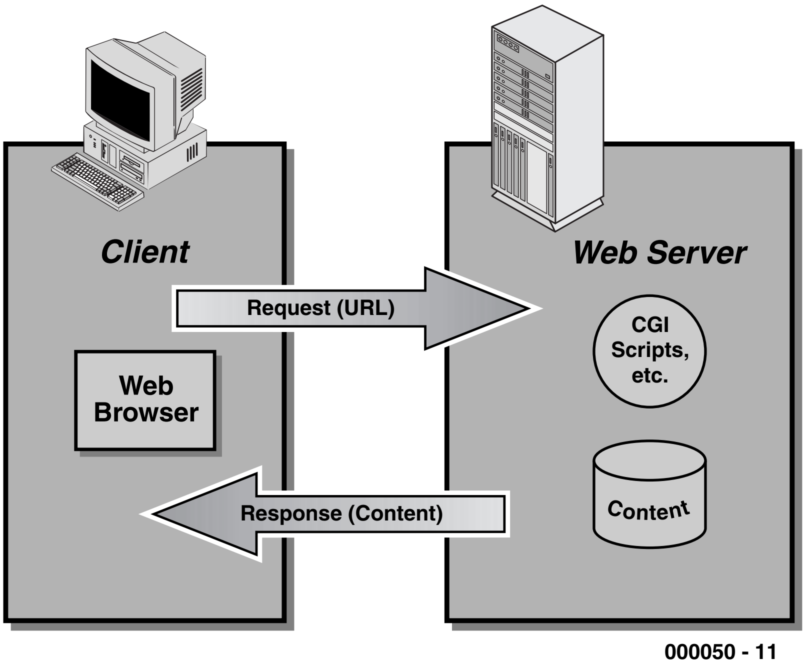

Figure 1. The structure of a WWW session. The client and server communicate with each other using a standardised protocol.

The WWW model

In order to properly understand how the WAP works, you first need to briefly examine how the Internet works (see **Figure 1**). The Internet model is a powerful and extremely flexible system, in which applications that run on a terminal (the client) utilise a standardised series of file formats and communications protocols. Most of these applications have by now been integrated into large, universal terminal programs

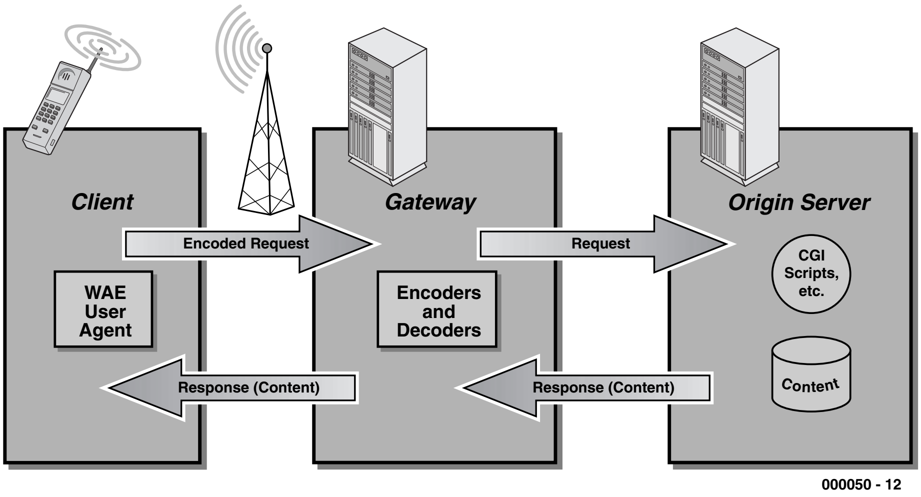

Figure 2. With a WAP connection, the content that the mobile terminal receives is tailored to the characteristics of the terminal. The intermediate gateway translates between the Internet and the world of the mobile network.

called web browsers. In practice, a web browser uses a standardised format (such as URL) and protocol (such as HTTP) to send a request for specific information to a log-in server. The log-in server starts a search for the request information and then sends the information to the browser in a standardised format (such as HTML). Several firm agreements are employed to make these data exchanges possible:

- a standard protocol is used for communication between the browser and the server (usually the Hypertext Transport Protocol, or HTTP);
- the sources on the Internet are addressed via Universal Resource Locators (URLs);
- the data formats that are used (for example, for text, sound and images) are clearly defined and should be understood by the browser that is used.

This standardised approach makes it possible to offer users quick and efficient access to information on the Internet.

An Internet user can make contact with the Internet in several different ways. Private users normally choose a dial-up connection to an Internet service provider (ISP). Firms and large offices frequently have fixed data links to the Internet.

In principle, a mobile phone can be used to make a dial-up connection to an Internet service provider, following which the Internet can be consulted. With a GSM connection, the maximum data rate that can be achieved in this manner is 9600 baud. This is too low for practical use, although there are a number of ways in which the situation can be improved, such as data compression and data optimisation. A better solution, which is now becoming available, is the WAP.

The WAP model

The WAP model employs a number of stacked protocol layers to offer the mobile user the desired functionality (see **Figure 2**). The Wireless Application Environment (WAE) is layer is at the top of the communications model. It largely corresponds to the WWW concept. However, in this case the protocol is optimised for use with mobile terminals. It employs the following items:

- Wireless Markup Language (WML), a derivative of HTML that is optimised for use with small terminals that have limited features;
- WMLScript, a simple scripting language comparable to JavaScript, which allows pages to be 'intelligent';
- Wireless Telephony Application (WTA or WTAI), an interface to the telephone functions and the programming environment;
- data formats, including images, text, telephone books and calendar information.

Several lower-level layers are needed to support the use of the WAE model. These are the Wireless Session Layer (WSL), which is the counterpart of the HTTP; the Wireless Transaction Protocol, which is the counterpart of the TCP; Wireless Transport Layer Security (WTLS) and the Wireless Datagram Protocol (WDP), which is the counterpart of the UDP. The combination of all of these layers provides a standardised and secure session. This allows users to perform secure transactions via the WAP, such as making payments. The functionality of WTLS is comparable to that of SSL in an HTTP session. **Figure 3** shows

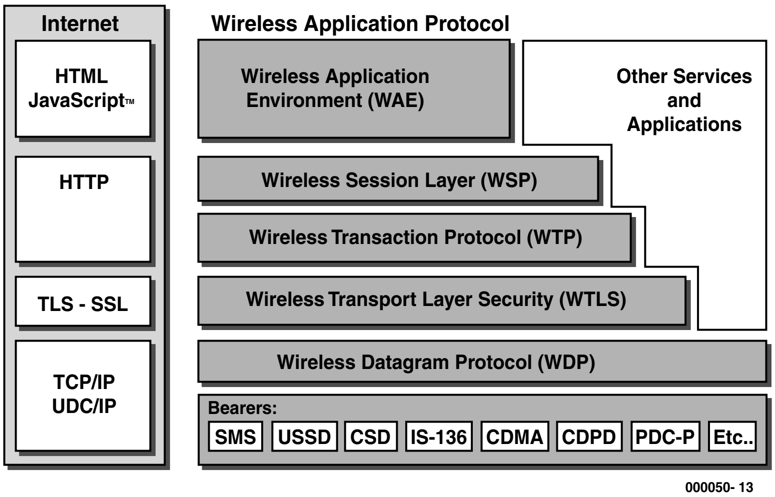
Internet
HTML
JavaScript™
HTTP
TLS - SSL
TCP/IP
UDC/IP
Wireless Application Protocol
Wireless Application Environment (WAE)
Other Services and Applications
Wireless Session Layer (WSP)
Wireless Transaction Protocol (WTP)
Wireless Transport Layer Security (WTLS)
Wireless Datagram Protocol (WDP)
Bearers:
SMS
USSD
CSD
IS-136
CDMA
CDPD
PDC-P
Etc..
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Figure 3. The structure of a 'normal' Internet connection based on the HTTP protocol (left), and a comparable connection using the WAP.

Figure 4. The Nokia 7110, the first telephone on the market that can be used as a stand-alone WAP terminal.

the relationships between the various layers of the WAP and similar layers in WWW traffic. The WAP is presently standardised, and an increasing number of products that comply with the most recent version (WAP 1.2) are appearing on the market.

The WAP ensures that the information that is requested from the Internet perfectly matches the capabilities of the mobile terminal that is used. The graphic information is kept extremely compact, and it is optimised for the browser that is used. If the browser supports colour, the information is delivered in colour. If the browser is limited to black-and-white, the information is adapted to match. By the way, the WAP standard is limited to black-and-white, but some manufacturers extend the standard with support for colour.

The screen resolution supported by the browser, and the limitations of a telephone keypad, are also taken into account as well as possible. This means that a modified telephone (such as the Nokia 7110) can even be used for surfing on the Internet. A thumbwheel (the 'Navi-roller') in this phone the allows the user to surf the net.

Practical considerations

In order to allow the WAP to be exploited as flexibly as possible, use of the protocol can be based on several different bearers (services). One of these is part of the GSM standard. Other mobile communication systems can also be used to make WAP sessions possible. These are located in the very bottom layer of the model shown in **Figure 3**.
If we limit our attention to the use of WAP in combination with the GSM network, we see that in addition to a standard dial-up link via a normal speech channel, it is possible to use the Short Message Services (SMS) or a packet-oriented data link (IP traffic). Presently, most operators offer WAP via a dial-up link using the speech channel. This means that a telephone connection is used for the duration of the WAP session, just as with a dial-up connection using the fixed telephone network.

If SMS is selected instead, communications between the client and the server are maintained with the aid of SMS messages. Up to 140 bytes (or 160 characters) can be sent in each message (text is coded using 7 bits in SMS traffic). If this information is used efficiently, the number of SMS messages per session can be kept to a minimum. When SMS is used, it does not matter how much time elapses between two successive actions in the terminal. Only when information is requested or supplied is there any activity on the mobile network (and thus charges). This approach requires the network operator to incorporate an extra server in the network. This server translates the received SMS instructions into tasks that can be processed by the WAP server.

The best option for working with the WAP is to use packet-switched data links. This communications protocol can be used once the mobile telephone network operator has implemented General Packet Radio Services (GPRS). With a GPRS connection, the mobile phone is connected to the network via a packet-oriented data link (IP). This effectively means that the GSM network is a subset of the Internet, and all of its mobile phones are IP terminals. This approach makes very efficient use of the available network bandwidth. For the user, the introduction of GPRS means that his or her telephone is always connected to the mobile network, and thus with the Internet. The fees that are charged in this case are based on the amount of data received, rather than on the amount of time used. GPRS will be implemented in the first mobile networks later this year.

With the combination of WAP and GPRS, it is possible to set triggers using the browser. For example, you could specify that you want to receive a message if the trading price of a particular stock goes above or below a certain level. As soon as the threshold level is reached, a message will appear on the screen of the terminal ('WAP push'). As long as GPRS is not available, the only way to deliver information at a particular time is to use SMS messages. As soon as the WAP is operating, the message is sent via this carrier and appears on the screen.

User information

Before information can be displayed by a WAP browser, it must be put into WML format. Content providers can open special WML sites for this purpose. The mobile surfer is then sent to the correct address by means of a particular URL. A number of providers of translation systems have also appeared on the market. These translators fetch HTML or XML information from the Internet and translate it into WML information. This makes it possible to maintain up-to-date information (such as stock exchange quotes, timetables and travel information) on a single site, while allowing it to be consulted in various manners using different types of platforms. Mobile network operators can incorporate this translation function in their networks, and thus offer 'tailored' information services to their customers.

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